CLAIMS

I/We claim:

[c1] 1. An electrochemical deposition chamber for depositing material onto microfeature workpieces, the chamber comprising:

a processing unit including a first flow system configured to convey a flow of a first processing fluid to a microfeature workpiece;

an electrode unit coupled to the processing unit, the electrode unit including an electrode and a second flow system configured to convey a flow of a second processing fluid at least proximate to the electrode; and

a nonporous barrier between the processing unit and the electrode unit to separate the first and second processing fluids, the nonporous barrier being a material that allows either cations or anions to pass through the barrier between the first and second processing fluids.

[c2] 2. The chamber of claim 1 wherein the nonporous barrier is an anion-selective exchange barrier that inhibits cations from passing between the first and second processing fluids.

[c3] 3. The chamber of claim 1 wherein the nonporous barrier is a cation-selective ion exchange barrier that inhibits anions from passing between the first and second processing fluids.

[c4] 4. The chamber of claim 1 wherein the nonporous barrier is flexible.

[c5] 5. The chamber of claim 1 wherein the nonporous barrier separates the flow of the first processing fluid from the flow of the second processing fluid.

[c6] 6. The chamber of claim 1 wherein the nonporous barrier allows electrical current to pass therethrough in the presence of an electrolyte.

[c7] 7. The chamber of claim 1, further comprising:

the first processing fluid, wherein the first processing fluid includes a catholyte; and

the second processing fluid, wherein the second processing fluid includes an anolyte.

[c8] 8. The chamber of claim 1, further comprising:

the first processing fluid, wherein the first processing fluid has a concentration of between approximately 10 g/l and approximately 200 g/l of acid; and

the second processing fluid, wherein the second processing fluid has a concentration of between approximately 0.1 g/l and approximately 200 g/l of acid.

[c9] 9. The chamber of claim 8 wherein the second processing fluid has a concentration of between approximately 0.1 g/l and approximately 1.0 g/l of acid.

[c10] 10. The chamber of claim 1, further comprising:

the first processing fluid, wherein the first processing fluid has a first concentration of acid; and

the second processing fluid, wherein the second processing fluid has a second concentration of acid, the ratio of the first concentration to the second concentration being between approximately 1:1 and approximately 20,000:1.

[c11] 11. The chamber of claim 1 wherein the electrode unit further comprises a plurality of electrodes.

[c12] 12. The chamber of claim 1 wherein:

the electrode is a first electrode;

the electrode unit further comprises a second electrode; and

the chamber further comprises a dielectric divider between the first electrode and the second electrode.

[c13] 13. The chamber of claim 1, further comprising a field shaping module to shape an electrical field in the first processing fluid induced by the electrode.

[c14] 14. The chamber of claim 1 wherein the nonporous barrier is canted relative to the processing unit to vent gas from the second processing fluid.

[c15] 15. The chamber of claim 1, further comprising a barrier unit coupled to the processing and electrode units, the barrier unit including the nonporous barrier.

[c16] 16. The chamber of claim 1 wherein:

the nonporous barrier includes a first side and a second side opposite the first side;

the first flow system is configured to flow the first processing fluid at least proximate to the first side of the nonporous barrier; and

the second flow system is configured to flow the second processing fluid at least proximate to the second side of the nonporous barrier.

[c17] 17. The chamber of claim 1 wherein the electrode comprises a pure copper electrode.

[c18] 18. The chamber of claim 1 wherein the electrode comprises a copper-phosphorous electrode.

[c19] 19. An electrochemical deposition chamber for depositing material onto microfeature workpieces, the chamber comprising:

a head assembly including a workpiece holder configured to position a microfeature workpiece at a processing site and a plurality of electrical contacts arranged to provide electrical current to a layer on the workpiece; and

a vessel including a processing unit for carrying one of a catholyte and an anolyte proximate to the workpiece, an electrode unit having an electrode and configured for carrying the other of the catholyte and the anolyte at least proximate to the electrode, and a semipermeable barrier between the processing unit and the electrode unit, wherein the semipermeable barrier selectively inhibits one of anions and cations from passing between the catholyte and the anolyte.

[c20] 20. The chamber of claim 19 wherein the semipermeable barrier is either a cation-selective ion exchange barrier or an anion-selective ion exchange barrier.

[c21] 21. The chamber of claim 19 wherein the semipermeable barrier separates a flow of the catholyte from a flow of the anolyte.

[c22] 22. The chamber of claim 19, further comprising a barrier unit coupled to the processing and electrode units, the barrier unit including the semipermeable barrier.

[c23] 23. A reactor for wet chemical processing of microfeature workpieces, the reactor comprising:

a processing unit for providing a first processing fluid to a microfeature workpiece;

an electrode unit including an electrode;

a barrier unit between the processing and electrode units, the barrier unit including either a semipermeable cation-selective ion exchange barrier or a semipermeable anion-selective ion exchange barrier;

a first flow system for carrying the first processing fluid, the first flow system including a first portion in the processing unit and a second portion in the barrier unit in fluid communication with the first portion in the processing unit; and

a second flow system for carrying a second processing fluid at least proximate to the electrode, the second flow system including a first portion in the electrode unit and a second portion in the barrier unit in fluid communication with the first portion in the electrode unit, wherein the ion exchange barrier separates the first processing fluid in the first flow system from the second processing fluid in the second flow system.

[c24] 24. A chamber for wet chemical processing of microfeature workpieces, the chamber comprising:

a first processing fluid having a concentration of between approximately 10 g/l and approximately 200 g/l of acid;

a processing unit carrying the first processing fluid and being configured to provide the first processing fluid to a microfeature workpiece;

a second processing fluid having a concentration of between approximately 0.1 g/l and approximately 1.0 g/l of acid;

an electrode unit carrying the second processing fluid and an electrode proximate to the second processing fluid; and

a semipermeable barrier between the processing unit and the electrode unit to separate the first and second processing fluids.

[c25] 25. The chamber of claim 24 wherein the semipermeable barrier inhibits either cations or anions from passing between the first and second processing fluids.

[c26] 26. The chamber of claim 24 wherein the first and second processing fluids each have a concentration of between approximately 10 g/l and approximately 50 g/l of copper.

[c27] 27. A chamber for wet chemical processing of microfeature workpieces, the chamber comprising:

a first processing fluid having a first concentration of acid;

a processing unit carrying the first processing fluid and being configured to provide the first processing fluid to a microfeature workpiece;

a second processing fluid having a second concentration of acid, the ratio of the first concentration to the second concentration being between approximately 10:1 and approximately 20,000:1;

an electrode unit carrying the second processing fluid and an electrode proximate to the second processing fluid; and

a nonporous barrier between the processing unit and the electrode unit to separate the first and second processing fluids.

[c28] 28. The chamber of claim 27 wherein the nonporous barrier inhibits anions from passing between the first and second processing fluids.

[c29] 29. The chamber of claim 27 wherein the first and second processing fluids each have a concentration of between approximately 10 g/l and approximately 50 g/l of copper.

[c30] 30. A system for wet chemical processing of microfeature workpieces, the system comprising:

a processing unit for providing a first electrolyte to a microfeature workpiece;

a first reservoir in fluid communication with the processing unit, the first reservoir and the processing unit being configured to carry a first volume of the first electrolyte;

an electrode unit for carrying a second electrolyte and an electrode proximate to the second electrolyte;

a second reservoir in fluid communication with the electrode unit, the second reservoir and the electrode unit being configured to carry a second volume of the second electrolyte, the first volume of the first electrolyte being at least twice the second volume of the second electrolyte; and

a semipermeable barrier between the processing unit and the electrode unit to separate the second electrolyte and the first electrolyte while permitting ions to pass between the second electrolyte and the first electrolyte.

[c31] 31. The system of claim 30 wherein the ratio of the first volume of the first electrolyte to the second volume of the second electrolyte is between approximately 1.5:1 and approximately 10:1.

[c32] 32. The system of claim 30, further comprising:

the first electrolyte, wherein the first electrolyte has a concentration of between approximately 10 g/l and approximately 50 g/l of copper; and

the second electrolyte, wherein the second electrolyte has a concentration of between approximately 10 g/l and approximately 50 g/l of copper.

[c33] 33. The system of claim 30, further comprising:

the first electrolyte, wherein the first electrolyte has a concentration of between approximately 10 g/l and approximately 200 g/l of acid; and

the second electrolyte, wherein the second electrolyte has a concentration of between approximately 0.1 g/l and approximately 1.0 g/l of acid.

[c34] 34. A method of electrochemically processing a microfeature workpiece, comprising:

flowing a first processing fluid at least proximate to a microfeature workpiece in a reaction chamber;

flowing a second processing fluid at least proximate to an electrode in the reaction chamber;

applying an electrical potential to the electrode to establish an electrical current flow in the first and second processing fluids; and

separating the first processing fluid and the second processing fluid with a semipermeable barrier to selectively inhibit one of anions and cations from passing between the first and second processing fluids.

[c35] 35. The method of claim 34 wherein separating the first and second processing fluids comprises separating the first and second processing fluids with a barrier that allows electrical current to pass therethrough in the presence of an electrolyte.

[c36] 36. The method of claim 34 wherein separating the first and second processing fluids comprises separating a flow of the first processing fluid from a flow of the second processing fluid.

[c37] 37. The method of claim 34 wherein:

flowing the first processing fluid comprises flowing a catholyte having a concentration of between approximately 10 g/l and approximately 200 g/l of acid; and

flowing the second processing fluid comprises flowing an anolyte having a concentration of between approximately 0.1 g/l and approximately 1.0 g/l of acid.

[c38] 38. The method of claim 34 wherein:

flowing the first processing fluid comprises flowing a catholyte having a first concentration of acid; and

flowing the second processing fluid comprises flowing an anolyte having a second concentration of acid, the ratio of the first concentration of acid to the second concentration of acid being between approximately 10:1 and approximately 20,000:1.

[c39] 39. The method of claim 34 wherein applying an electrical potential to the electrode comprises applying an electrical potential to a plurality of electrodes.

[c40] 40. The method of claim 34 wherein the semipermeable barrier includes a first side and a second side opposite the first side, and wherein the method further comprises:

flowing the first processing fluid at least proximate to the first side of the semipermeable barrier; and

flowing the second processing fluid at least proximate to the second side of the semipermeable barrier.

[c41] 41. The method of claim 34 wherein:

the first processing fluid is a first charge carrying fluid for carrying a first charge across the barrier; and

the second processing fluid is a second charge carrying fluid for carrying a second charge across the barrier.

[c42] 42. The method of claim 41 wherein the first and second charge carrying fluids include anions.

[c43] 43. The method of claim 41 wherein the first and second charge carrying fluids include cations.

[c44] 44. The method of claim 41 wherein charge carriers in the first and second charge carrying fluids move in opposite directions when the reaction chamber is operating and idle.

[c45] 45. A method of electrochemically processing a microfeature workpiece, comprising:

flowing a first processing fluid having a concentration of between approximately 10 g/l and approximately 200 g/l of acid at least proximate to a microfeature workpiece in a wet chemical processing tool;

flowing a second processing fluid having a concentration of between approximately 0.1 g/l and approximately 1.0 g/l of acid at least proximate to an electrode in the wet chemical processing tool;

applying an electrical potential to the electrode to establish an electrical current flow in the first and second processing fluids; and

separating the first processing fluid and the second processing fluid with a semipermeable barrier.

[c46] 46. A method of electrochemically processing a microfeature workpiece, comprising:

flowing a first processing fluid having a first ion concentration at least proximate to a microfeature workpiece in a wet chemical processing tool;

flowing a second processing fluid having a second ion concentration at least proximate to an electrode in the wet chemical processing tool;

applying an electrical potential to the electrode to establish an electrical current flow in the first and second processing fluids; and

separating the first processing fluid and the second processing fluid with a semipermeable barrier, the first and second ion concentrations being selected to control a majority charge carrier and a concentration balance across the semipermeable barrier.

[c47] 47. A method of electrochemically processing a microfeature workpiece, comprising:

flowing a first processing fluid having a first concentration of acid at least proximate to a microfeature workpiece in a wet chemical processing tool;

flowing a second processing fluid having a second concentration of acid at least proximate to an electrode in the wet chemical processing tool, the ratio of the first concentration of acid to the second concentration of acid being between approximately 10:1 and approximately 20,000:1;

applying an electrical potential to the electrode to establish an electrical current flow in the first and second processing fluids; and

separating the first and second processing fluids with a cation-selective ion exchange barrier.

[c48] 48. A method of electrochemically processing a microfeature workpiece, comprising:

flowing catholyte through a first flow system of a wet chemical processing tool and at least proximate to a microfeature workpiece, the first flow system being configured to carry a first volume of catholyte;

flowing anolyte through a second flow system of the wet chemical processing tool and at least proximate to an electrode, the second flow system being configured to carry a second volume of anolyte, the first volume of catholyte being at least twice the second volume of anolyte;

applying an electrical potential to the electrode to establish an electrical current flow in the first and second processing fluids; and

separating the catholyte and the anolyte with a nonporous barrier.